

No. 704,326.

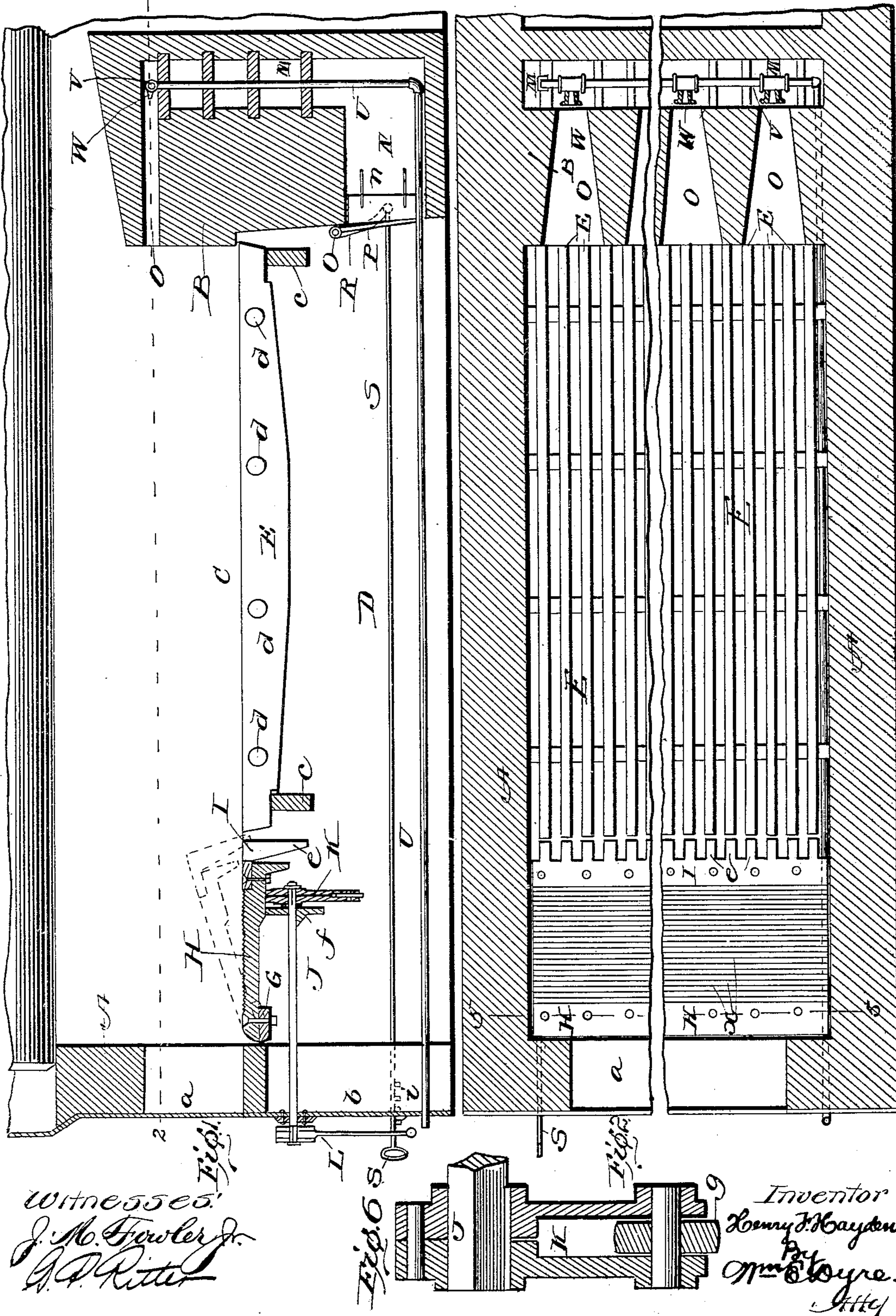
Patented July 8, 1902.

H. F. HAYDEN.
SMOKE PREVENTING FURNACE.

(Application filed Mar. 8, 1902.)

(No Model.)

3 Sheets—Sheet 1.



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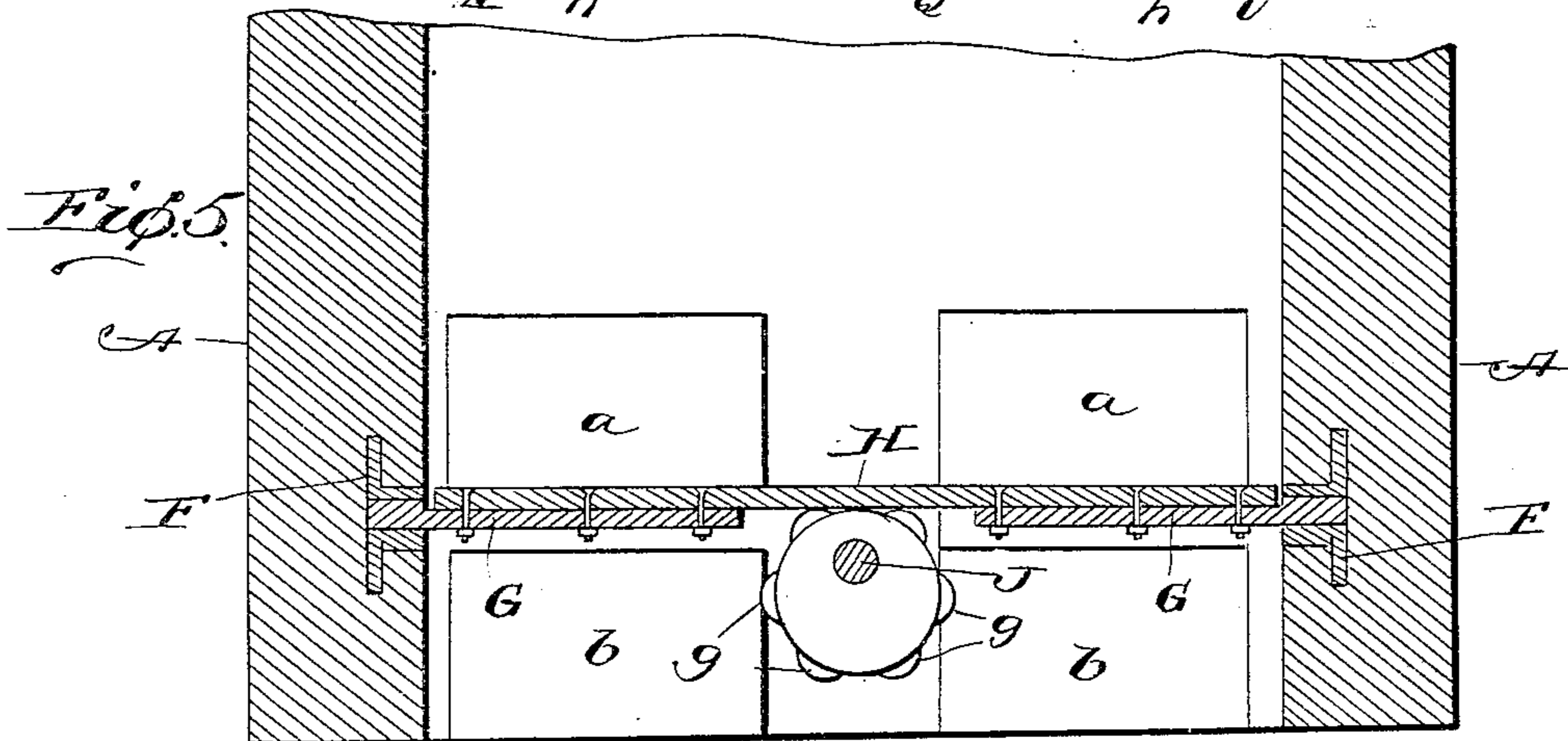
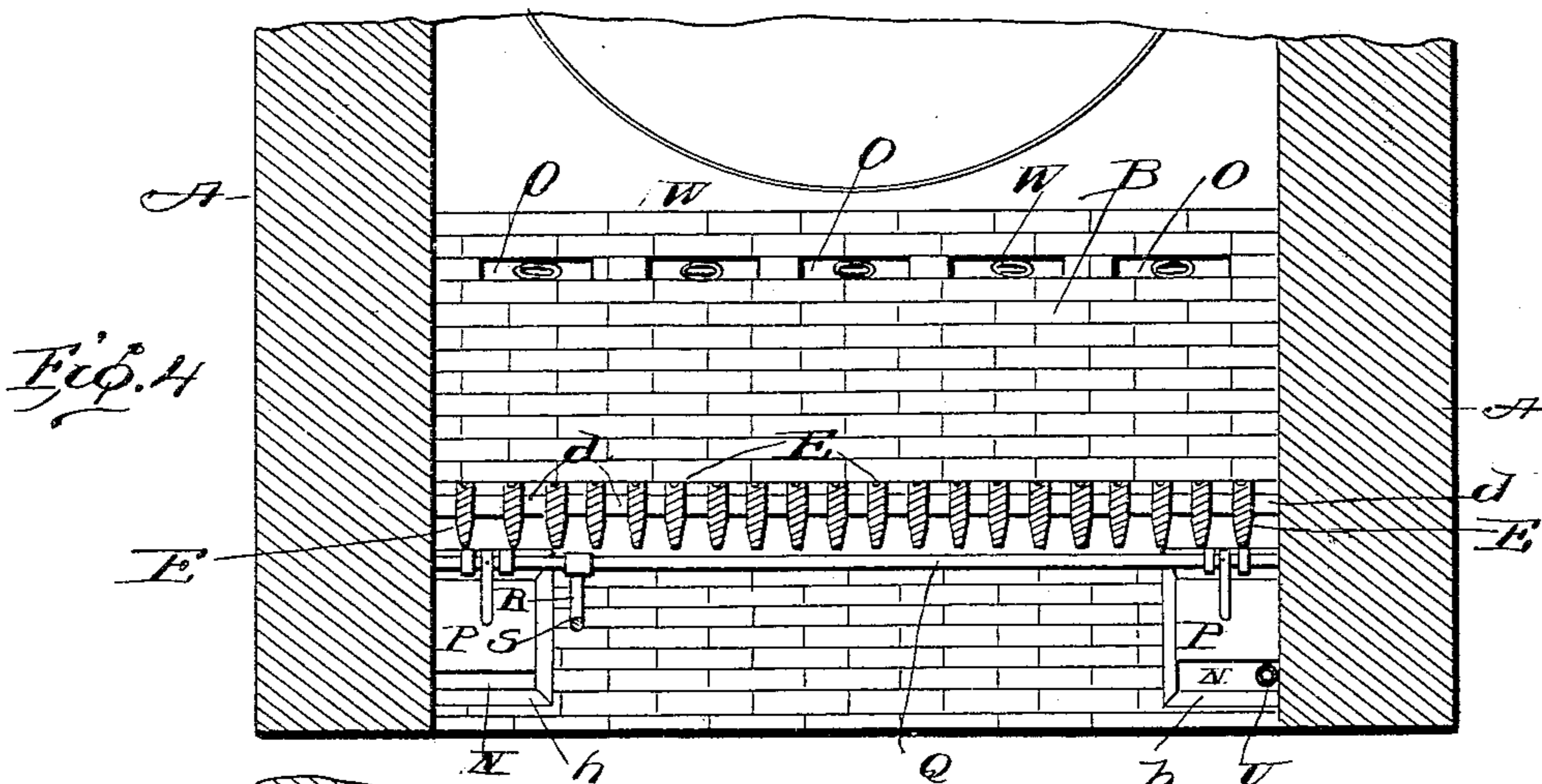
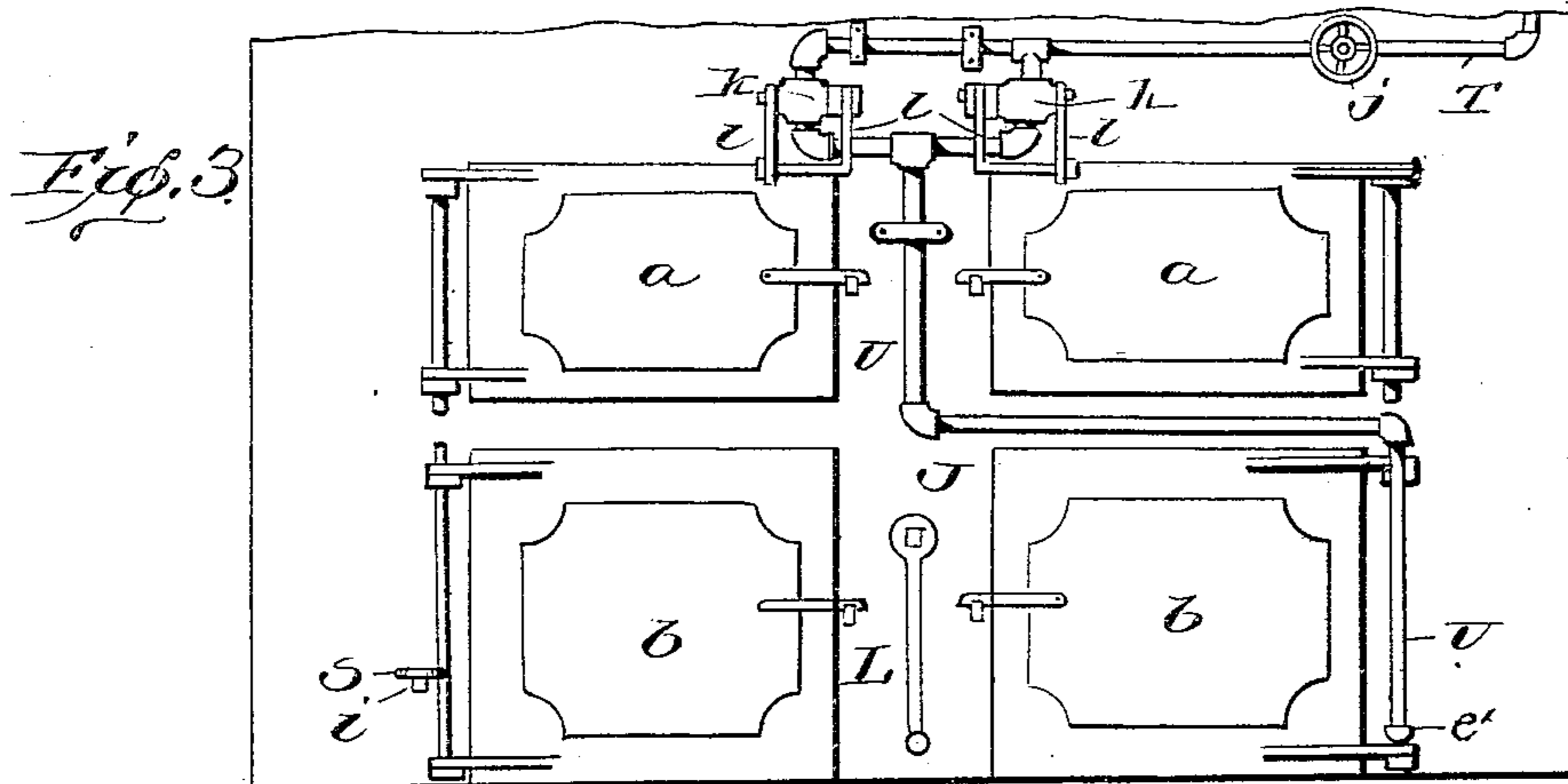
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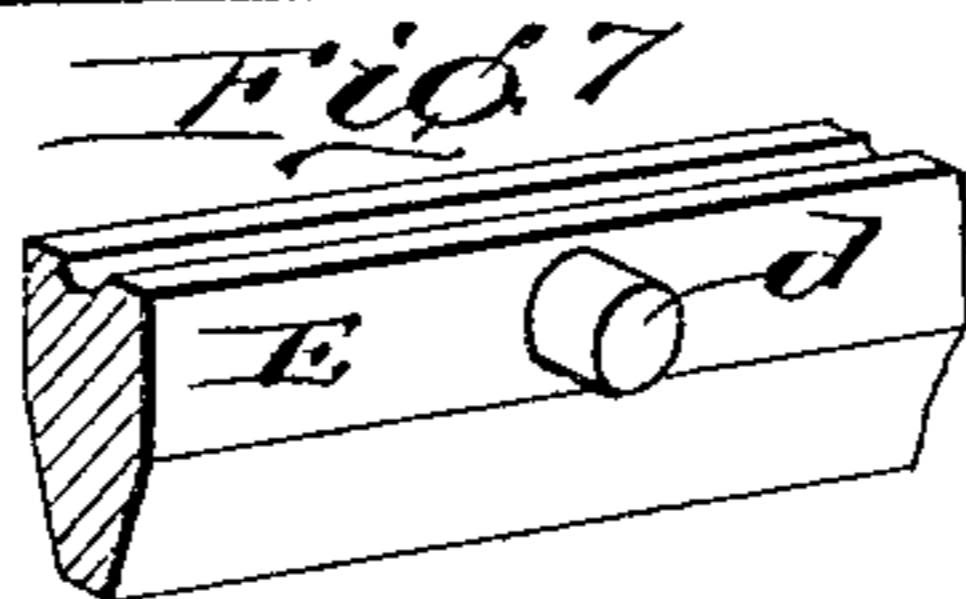
(Application filed Mar. 3, 1902.)

(No Model.)

3 Sheets—Sheet 2.



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J. H. Fowler Jr.
G. F. Ritter



Inventor
Henry F. Hayden
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Att'y

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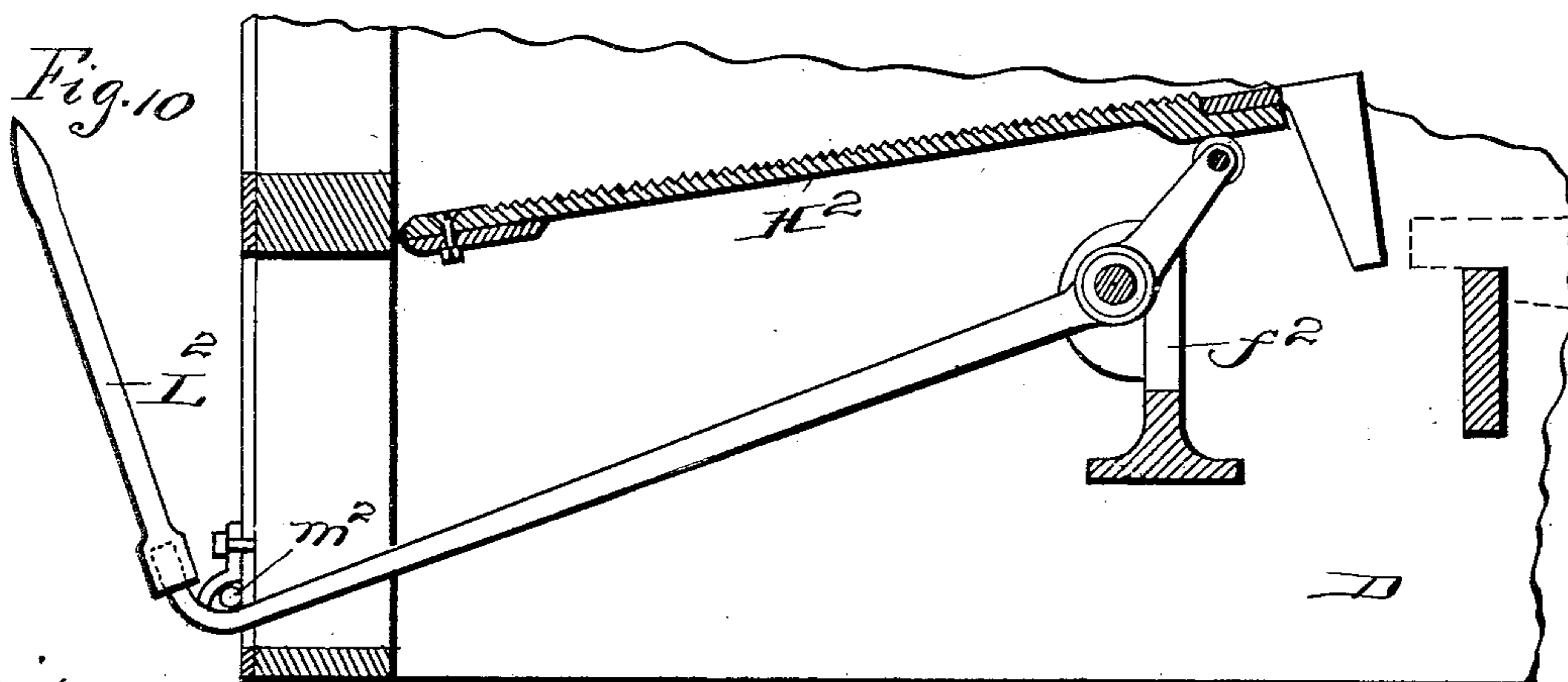
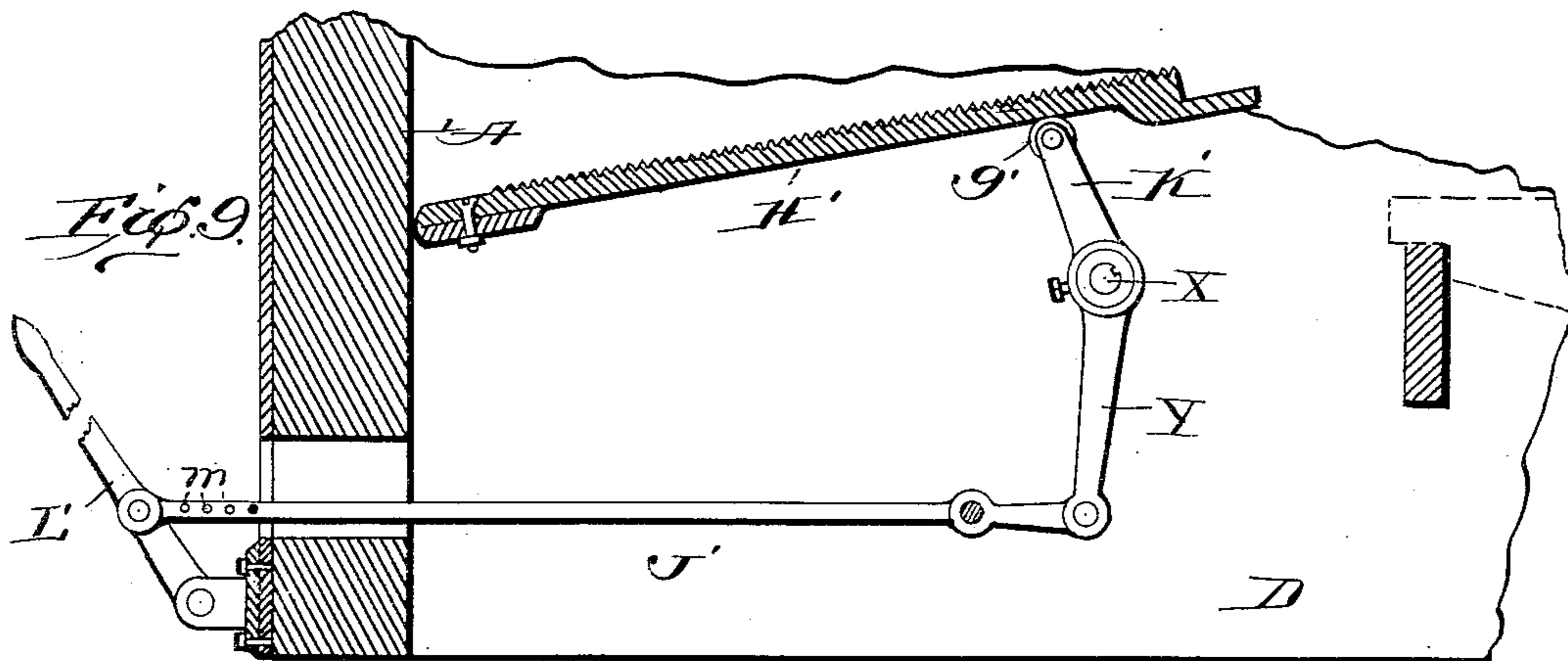
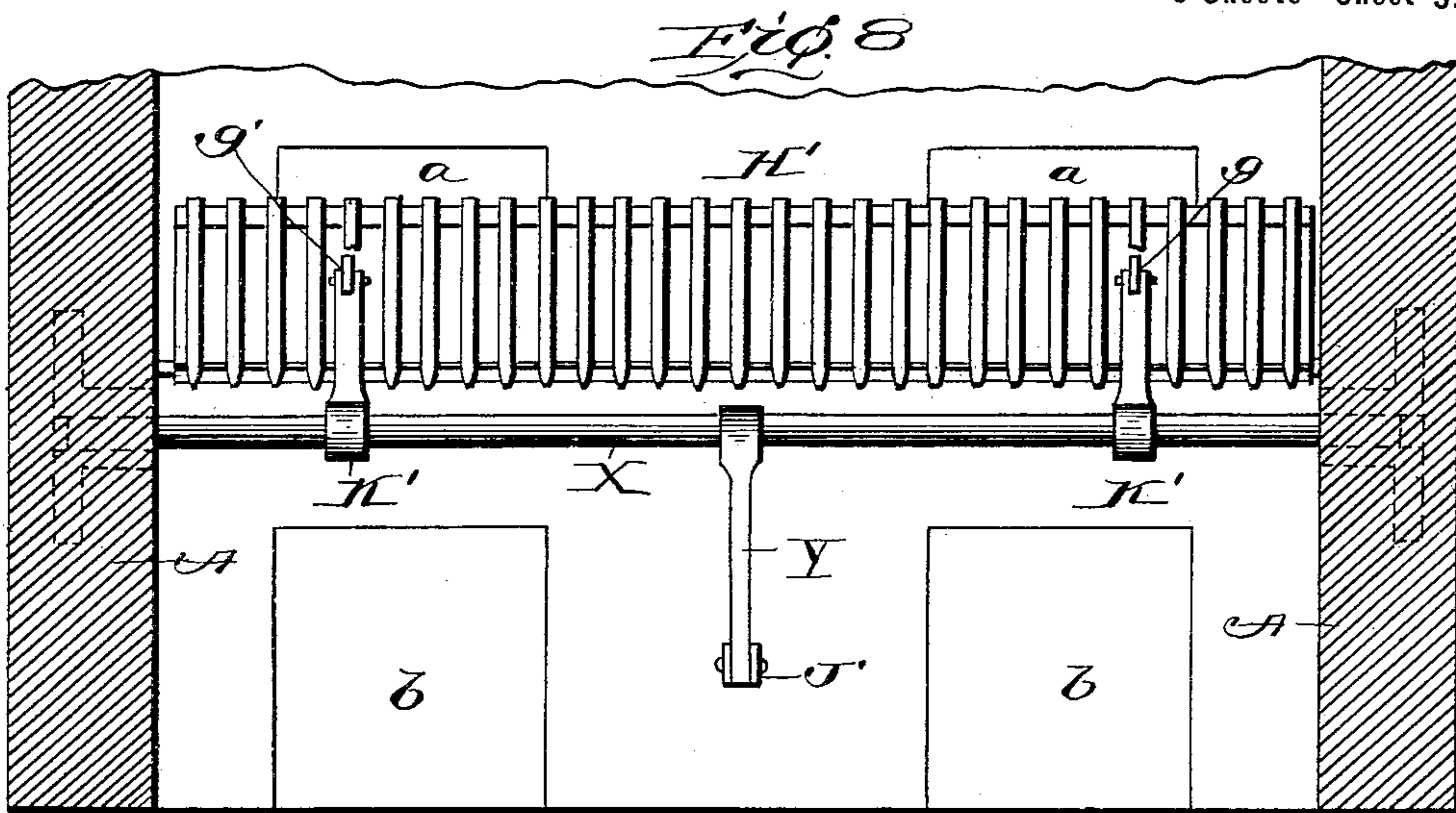
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3 Sheets—Sheet 3.



witnesses:

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UNITED STATES PATENT OFFICE.

HENRY F. HAYDEN, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR
OF ONE-THIRD TO JAMES HENRY JENNINGS, OF WASHINGTON, DISTRICT
OF COLUMBIA.

SMOKE-PREVENTING FURNACE.

SPECIFICATION forming part of Letters Patent No. 704,326, dated July 8, 1902.

Application filed March 3, 1902. Serial No. 96,438. (No model.)

To all whom it may concern:

Be it known that I, HENRY F. HAYDEN, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Smoke-Preventing Furnaces; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to boiler-furnaces such as employed in generating steam for driving stationary or portable engines or for other purposes.

More particularly stated, the invention resides in certain peculiarities of construction and novel arrangement of parts whereby a maximum degree of heat is produced by a minimum expenditure of fuel, be it anthracite or bituminous coal, petroleum, or other combustible materials.

The chief objects of my present invention are, therefore, to secure in furnaces a most thorough and complete combustion of all gases, to prevent the formation of smoke or, as commonly expressed, to "consume" it, and also to increase the general efficiency or steam-producing qualities of boilers when heated by furnaces embodying my invention.

In the practical accomplishment of these several objects the leading features of construction may be said to embrace means for feeding fuel to furnaces after having first practically coked same; means for supplying air in predetermined and suitable proportions to commingle and burn with the furnace-gases, as also for beating down and retarding in fire-chambers the traveling unconsumed products of combustion until same have been entirely consumed.

Additional features of my invention which contribute to the successful results obtained and constitute elements in the organized arrangement of parts, hereinafter more fully described, are a pivotally-arranged and vertically-movable dead-plate of novel construction constituting a coking-surface for the reception of fresh fuel; mechanism for actuating or elevating said dead-plate; the novel

arrangement of an air-chamber, delivery-ports, and air-ducts formed in the bridge-wall for establishing a counter-current of heated air from the ash-pit through the bridge-wall and over the fire-chamber; means for automatically introducing steam to said delivery-ports for creating the counter-currents of heated air, as aforesaid, and a system of dampers actuated from in front of the furnace for guarding the entrance of air-ducts in the bridge-wall, all as will be hereinafter more fully set forth, and particularly pointed out in the claims following.

In the accompanying drawings, which form part of this specification, and whereon corresponding letters indicate like parts in the several views, Figure 1 represents a longitudinal vertical section through a furnace equipped with my improvements. Fig. 2 is a horizontal section above the dead-plate, grate-bars, and bridge-wall, taken on the line 2 2 of Fig. 1. Fig. 3 is a front elevation of furnace, showing pipes and mechanism for automatically introducing steam for reversing the draft. Fig. 4 is a central transverse vertical section through furnace looking in the direction of the bridge-wall. Fig. 5 is a zigzag vertical section, indicated by the dotted line 5 5 on Fig. 2, looking outward against the furnace-front. Figs. 6 and 7 are fragmentary views, the former being a central vertical section through cam for elevating the dead-plate and the latter a portion of one grate-bar in perspective. Figs. 8 and 9 are transverse and longitudinal sections, respectively, through a furnace fitted with a modified form of mechanism for elevating or lowering the dead-plate; and Fig. 10 is also a modification in longitudinal section of mechanism similar to that illustrated by Fig. 9.

Reference being had to the drawings and letters thereon, A indicates the walls of a furnace, and B its bridge-wall, the latter located as usual, but of special construction.

C represents the fire-chamber, D the ash-pit, *a a* the furnace-doors, and *b b* the ash-pit doors, the foregoing all of ordinary or of any approved construction. Secured in the side walls A A at suitable points are metallic

girders *c c*, which bridge ash-pit D transversely and serve as the support for grate-bars E in parallel arrangement, as shown by Figs. 1 and 2. The bars E each have cast upon one side a series of laterally-projecting bosses *d*, serving to keep said bars separated and equidistant, for obvious reasons, while the single bar adjacent to the right-hand side wall of the furnace is provided with a series of bosses *d* upon both of its sides in order to separate it from said wall as well as its adjacent grate-bar.

At the extreme front of the furnace and in flanged thimbles F F, set into the side walls, are trunnion-bars G G, to which is securely bolted a dead-plate H of a length substantially equal to the width of the furnace and configured by a series of serrations *x* upon its surface, for purposes that will later appear.

To the inner or movable edge of dead-plate H is bolted an auxiliary grate I, comprising angular downwardly-extending stationary grate-bars *e* in register with the main bars E, while beneath is a rotatable shaft J, its outer end projecting through the furnace-front and its inner end through a supporting-girder *f*, fixed in the side walls A A similarly as are the girders *c c*. To the inner extremity of shaft J is eccentrically secured a two-part cam K, between the members whereof are journaled friction-rollers *g*, two of which latter are at all times in bearing upon the under side of the dead-plate. The dead-plate may accordingly be elevated to the position indicated by dotted lines in Fig. 1 or lowered to the plane of the main grate-bars E, as occasion requires, by a half-rotation of shaft J through agency of a suitable lever L, keyed to its projecting outer end.

Within the bridge-wall B is formed a vertical air-chamber M, communicating with the ash-pit D by means of horizontal side ducts N N and with the fire-chamber C above by way of a series of diverging air-ports O, also horizontally arranged and immediately beneath the top of the wall. These side ducts N N are protected at their entrance by inwardly-projecting rectangular metallic frames *n*, surrounded by flaring flanges *h*, as best shown by Fig. 4. Upon the uppermost of such flanges *h* is suitably hinged dampers P P, connected and controlled by a cross-shaft Q, this in turn controlled by an affixed lever R and a damper-rod S, leading to and through furnace-front, where same is fitted with a rack *i* of ordinary construction for retaining said rod and dampers in a predetermined position.

At front of the furnace is a steam-pipe T, communicating with and supplied from the boiler or any source of steam-supply. This pipe is fitted with an ordinary reduction-valve *j* for regulating the degree of pressure, and with plug-valves *k k*, by either of which when open steam may be introduced to pipe U.

Entering the furnace-front, as at *e'*, said pipe U passes through ash-pit D, one of the ducts N, and thence up through air-chamber

M, where it terminates in a suitably-supported horizontal delivery-pipe V, fitted with nozzles W in register with the air-ports O.

This being a description of my invention in its preferred form of construction, it will be noted that various changes in the arrangement, construction, and combination of parts may be made and substituted for those hereinbefore described without departing from the spirit of my invention. For example, modifications of mechanism for elevating and lowering the dead-plate H are illustrated by Figs. 8, 9, and 10 of the drawings, wherein a system of levers is employed in lieu of the cam K. To the rock-shaft X of Figs. 8 9 are affixed levers K' K', bearing in their uppermost bifurcated ends friction-rollers *g'*, the latter bearing upon the under side of the dead-plate H'.

At a point on shaft X intermediate of the levers K' K' is secured downwardly-projecting lever Y, to which is pivotally connected a pull-rod J', in turn actuated by an additional lever L', pivotally mounted upon the furnace-front. Near its outer protruding end the pull-rod J' may be perforated, as at *m*, for the reception of a locking-pin, which thus retains it in a predetermined position.

The modification represented by Fig. 10 employs a lever of the third order for actuating the dead-plate H², same being fulcrumed in a suitable girder *f*², fixed in the side walls of the furnace. At its outwardly-projecting power end, this main lever is augmented by an additional detachable lever L², and is adapted to be locked in a depressed position as shown by lugs *m*² bolted to the furnace-front, beneath which and above the depressed lever a locking-pin may be inserted.

Having thus described my invention, its use and operation may be briefly stated as follows: Presuming for purposes of illustration fire to have been started upon the main grate E in the usual manner, dead-plate H may now be elevated to its normal position, where it rests upon two of the friction-rollers *g*, as indicated by dotted lines on Fig. 1, by a half-turn of shaft J and the consequent half-rotation of cam K. Auxiliary grate I, having thus been thrown up into service, operates by agency of its downwardly-extending angular bars *e* to prevent fuel falling into ash-pit D from the end of bars E when the dead-plate is elevated and in addition to this function performs at same time one of even greater importance—namely, that of insuring at all times an end draft directly into and through the body of burning fuel at a point usually devoid of draft except from below. A fresh supply of fuel may now be thrown upon the elevated dead-plate H, its transverse serrations *x* assisting to retain same upon the inclined surface of the plate, where it is gradually heated and coked. This fuel in a highly-heated condition may then be readily pushed from the dead-plate by a stoking implement and distributed uniformly

over the fire, during which operation, as also during the process of coking, the lighter gases expelled by the action of heat receive their chemical equivalent of highly-heated oxygen through the elevated auxiliary grate and the air-ports O in the bridge-wall B and are instantly converted into flame and consumed. When found necessary to slice the fire, dead-plate H may be quickly lowered to the plane of bars E by a reversal of the operation heretofore described. Upon opening either furnace-door or both for the purpose of feeding fuel, slicing the fire, or for any other purpose steam is automatically admitted to pipe U, as before described, and serves to induce a maximum flow of hot air from ash-pit D through the passages in bridge-wall B to diverging ports O. As the result of this induced current a continuous sheet of highly-heated oxygen is forcibly delivered from ports O at face of the bridge-wall in the direction of the furnace-doors directly over the fire-chamber D for the purpose of reversing the natural draft of the furnace, retarding the traveling products of combustion until they are wholly consumed, and furnishing an increased proportion of heated oxygen to assist in effecting such complete combustion. If under the natural draft too large a proportion of heated air is conducted through the bridge-wall and over the fire-chamber, this is conveniently regulated by partially closing air-ducts N N by aid of dampers P P, actuated from in front of the furnace by the damper-rod S.

Having thus described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. In a furnace for preventing the formation of smoke the combination with a fire-chamber and stationary grate-bars, of a dead-plate extending from wall to wall of the furnace and pivotally supported at its outer edge in said walls, and means for raising the dead-plate above the horizontal plane of the stationary grate-bars, substantially as described.

2. In a furnace for preventing the formation of smoke the combination with a fire-chamber and stationary grate-bars, of a dead-plate extending from wall to wall of the furnace and pivotally supported at its outer edge in said walls, an auxiliary grate secured to the inner edge of said dead-plate, and means for elevating the dead-plate above the horizontal plane of the stationary grate-bars, substantially as described.

3. In a furnace for preventing the formation of smoke the combination with a fire-chamber provided with stationary grate-bars, of a dead-plate extending from wall to wall of the furnace and pivotally supported at its outer edge in said walls, a downwardly-projecting auxiliary grate secured to the inner edge of said dead-plate, and means for elevating the dead-plate above the horizontal plane of the stationary grate-bars, substantially as described.

4. In a furnace for preventing the formation of smoke the combination with a fire-chamber and stationary grate-bars of a dead-plate extending from wall to wall of the furnace and pivotally supported at its outer edge in said walls, and a cam beneath said dead-plate for elevating or lowering it, a forwardly-projecting cam-shaft, and a lever applied to said shaft for rotating it, substantially as described.

5. In a furnace for preventing the formation of smoke the combination with a pivotally-supported dead-plate having a serrated surface, of a suitable cam and cam-shaft for elevating or lowering the dead-plate, and a lever applied to said shaft for rotating it, substantially as described.

6. In a furnace for preventing the formation of smoke the combination with a fire-chamber, of main stationary grate-bars offset from each other by laterally-projecting side lugs, a dead-plate extending from wall to wall of the furnace and pivotally supported at its outer edge in said walls, a downwardly-projecting detachable auxiliary grate secured to the inner movable edge of the dead-plate, and means for elevating said dead-plate and auxiliary grate above the horizontal plane of said stationary grate-bars, substantially as described.

7. In a furnace for preventing the formation of smoke the combination with a fire-chamber, of a pivotally-supported dead-plate at the front of said chamber, means for raising the dead-plate above the horizontal plane of the stationary grate-bars, and means for introducing air from the bridge-wall to the fire-chamber, substantially as described.

In testimony whereof I subscribe my signature in presence of two witnesses.

HENRY F. HAYDEN.

Witnesses:

HUGH M. STERLING,
J. H. JENNINGS.